

A

PATENT

Attorney Docket No.

Express Mail Label No. EM574500529US

jc551 U.S. PTO

09/109139

07/02/98

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:

Appl.: John B. Taylor

Group Art Unit: 1616

Serial No.:

Attorney Docket No.:

Filed:

Examiner: A. Robinson

FOR: PLANT FERTILIZER COMPOSITIONS CONTAINING
PHOSPHONATE AND PHOSPHATE SALTS AND DERIVATIVES
THEREOF

July 2, 1998

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

FILING OF APPLICATION UNDER 37 CFR 1.53(b)

This is a request for a divisional application for patent under 37 CFR §1.53 of pending prior application for patent by John B. Taylor, Serial No. 08/812,865, filed March 6, 1997 which is a continuation-in-part of Serial No. 08/705,594, filed August 30, 1996.

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this Transmittal and any other documents referred to as enclosed herewith are being deposited with the United States Postal Service on July 2, 1998 in an envelope as "Express Mail Post Office to Addressee" Mailing Label No. EM574500529US addressed to "Box Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231."


Wendy L. Precht

jc587 U.S. PTO
07/02/98

09/109139 - 07/02/98

Attached are true copies of the papers of the complete prior application as originally filed.

- (a) 22 pages of specification, including 13 claims (3 pages) and an Abstract (1 page); and
- (b) Declaration and Power of Attorney (5 pages).

Please amend this application by inserting on page 1 of the application before line 1, the following:

This application is a division of copending U.S. patent application, Serial No. 08/812,865, filed March 6, 1997 which is a continuation-in-part of U.S. Serial No. 08/705,594, filed August 30, 1996.

With respect to the prior copending U.S. application from which this application claims benefit under 35 U.S.C. 120, the inventor in this application is the same.

Applicant has established small entity status by the filing of a statement in parent applications 08/812,865 and 08/705,594.

Also, before computing the filing fee for this application, please cancel claims 1 through 6 and 10, inclusively, without prejudice.

Enclosed is a Preliminary Amendment to be entered after the granting of the filing date and serial number herein. The number of claims in the application following entry of this Preliminary Amendment will be as follows:

Claims Remaining After Amendment				Number Extra			Rate	Basic Fee
								\$ 395.00
Total Claims	12	-	20	=	0	X	\$22.00	\$ 0.00
Independent Claims	3	-	3	=	0	X	\$ 78.00	\$ 0.00
Filing Fee Calculation								\$395.00

Our check in the amount of \$395.00 in payment of the filing fee is enclosed herewith. The Commissioner is hereby authorized to charge any additional fees necessary for the filing of this application to Deposit Account 12-0600. A duplicate copy of this filing form is included.

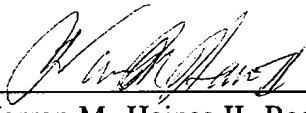
The current Power of Attorney in the copending prior application remains in effect for this application.

Please address all correspondence and direct all telephone calls regarding this application to:

Warren M. Haines II, Esq.
Donald R. Schoonover, Esq.
William A. Rudy, Esq.
Peter C. Knops, Esq.
Lathrop & Gage, L.C.
2345 Grand Boulevard, Suite 2500
Kansas City, Missouri 64108
Telephone: (816) 292-2000
Facsimile: (816) 292-2001

Respectfully submitted,

John B. Taylor

By: 
Warren M. Haines II, Reg. No. 40,632
Donald R. Schoonover, Reg. No. 34,924
William A. Rudy, Reg. No. 34,916
Peter C. Knops, Reg. No. 37,659
Lathrop & Gage, L.C.
2345 Grand Blvd., #2800
Kansas City, MO 64108
Telephone: (816) 460-5860
Facsimile: (816) 292-2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of:

Appl.: John B. Taylor

Group Art Unit: 1616

Serial No.:

Attorney Docket No.

Filed:

Examiner: A. Robinson

FOR: PLANT FERTILIZER COMPOSITIONS CONTAINING PHOSPHONATE
AND PHOSPHATE SALTS AND DERIVATIVES THEREOF

July 2, 1998


PRELIMINARY AMENDMENT

Box Patent Application
Assistant Commissioner for Patents
Washington, DC 20231

In furtherance of the prosecution of the subject matter disclosed in the above-
identified prior application, please enter the following preliminary amendment:

CERTIFICATION UNDER 37 C.F.R. § 1.10

I hereby certify that this document is being deposited with the United States Postal Service on July 2, 1998, in an envelope as "Express Mail Post Office to Addressee" Mailing Label No. EM574500529US addressed to "**Box Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231.**"


Wendy L. Precht

IN THE SPECIFICATION:

--CROSS REFERENCE TO RELATED APPLICATION

This application is a division of copending U.S. patent application Serial No. 08/812,865, filed March 6, 1997 which is a continuation-in-part of U.S. Serial No. 08/705,594, filed August 30, 1996.

IN THE CLAIMS:

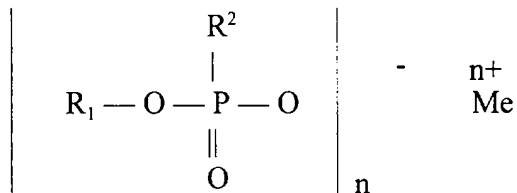
Please cancel claims 1-6 and 10.

Please amend claims 7, 11, 12 and 13 as follows:

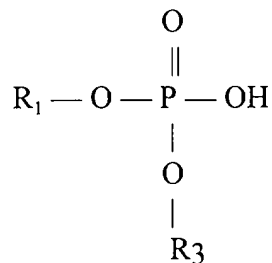
7. (Amended) A composition for fertilizing comprising:

a growth stimulating effective amount of at least a first salt having the following

formula:



and a second salt having the following formula:



where R₁ is selected from the group consisting of H, K, an alkyl radical containing from 1 to 4 carbon atoms, halogen-substituted alkyl or nitro-substituted alkyl radical, an alkenyl, halogen-substituted alkenyl, alkynyl, halogen-substituted alkynyl, alkoxy-substituted alkyl radical, and ammonium substituted by alkyl or hydroxy alkyl radicals;

R₂ and R₃ are selected from [a] the group consisting of H and K;

Me is selected from [a] the group consisting of K, alkaline earth metal cations, [or] aluminum atom[;], and ammonium cation; and

n is a whole number from 1 to 3, equal to the valence of Me.

11. (Amended) A [fungicidal/fertilizer] composition for stimulating growth and controlling fungus disease in plants comprising from about .25% vol./vol. to about 5% vol./vol. of a phosphite salt and a phosphate salt mixture.

12. (Amended) A composition according to claim [10] 11 wherein the phosphite salt and the phosphate salt each comprise about 1/2% by weight of the composition.

13. (Amended) A composition according to claim [10] 11 which is aqueous.

Please add claims 14 through 19 as follows.

14. A composition for enhancing growth of plants and for controlling pathogens in plants, comprising enhanced pathogen-controlling effective and growth-response effective amounts of phosphate and phosphonate.

15. The composition of claim 14, comprising amounts of phosphonate to be effective in the control of pathogens and growth-response effective amounts of phosphate.

16. The composition of claim 14, comprising a amount of phosphate effective to eliminate pathological acerbation of the growth of Ascomycete fungus by the phosphonate.

17. The composition of claim 14, wherein the phosphate is a potassium phosphate salt.

18. The composition of claim 14, wherein the phosphonate is a potassium phosphonate salt.

19. The composition of claim 14, wherein the concentration of the phosphonate is one part by weight and the concentration of the phosphate is between .001 and 1000 parts by weight.

REMARKS:

Applicant requests entry of this Preliminary Amendment prior to examination of the accompanying patent application which is a division of copending U.S. patent application Serial No. 08/812,865.

The specification has been amended to cross-reference the prior related application. Original claims 1-6 and 10 have been canceled and claims 7, 11, 12 and 13 have been amended. New claims 14 through 19 have been added to seek additional coverage for subject matter contained in the original disclosure as filed.

All of the changes in this Preliminary Amendment are believed to find support within the originally filed application and are urged to contain no new matter.

The Examiner is invited to contact the undersigned at the below-listed telephone number if it is felt that prosecution of the application may be expedited thereby.

Respectfully submitted,

John B. Taylor

BY: 

Warren M. Haines II, Reg. No. 40,632
LATHROP & GAGE, L.C.
2345 Grand Boulevard
Kansas City, Missouri 64108
Telephone: (816) 460-5427
Facsimile: (816) 292-2001

Inventor: John Taylor

Title: Plant Fertilizer Compositions Containing
Phosphonate and Phosphate Salts, and Derivatives Thereof

Cross-Reference to Related Application

The present invention is a continuation-in-part of co-pending Serial Number 08/705,594 filed on August 30, 1996.

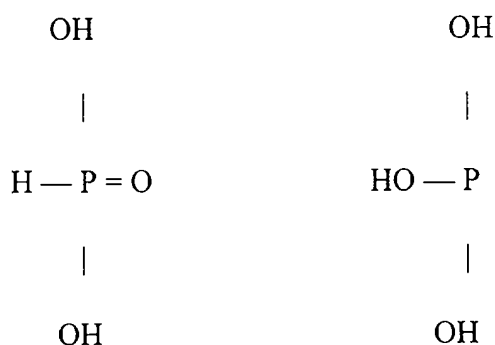
Background of the Invention

The present invention is broadly concerned with fungicidal compositions, and methods of use, which provide improved efficacy in controlling parasitic fungi in plants. More particularly, the compositions and methods of use of the invention include fungicidally effective amounts of both phosphate, preferably in the form of either mono, di, tri or dipotassium phosphate (KH_2PO_4 , K_2HPO_4) and phosphonate, preferably in the form of either mono or dipotassium phosphonate (KH_2PO_3 , K_2HPO_3), in aqueous solution.

According to another aspect of the present invention, the compositions and methods of use of the invention include growth response effective amounts of both phosphate, preferably in the form of either mono or dipotassium phosphate (KH_2PO_4 , K_2HPO_4) and phosphonate, preferably in the form of either mono or dipotassium phosphonate (KH_2PO_3 , K_2HPO_3), in aqueous solution.

Phosphorus is an essential major element in plant nutrition because it governs the energy producing reactions, including those that are oxidative, and photophosphorylative and the production of adenosine diphosphate (ADP) and adenosine triphosphate (ATP). Energy-rich phosphate bonds of ADP and ATP provide the energy for many of the physiological reactions that occur in plants.

The element phosphorous appears in two general forms that concern the present invention — phosphonate and phosphate. The term “phosphonate,” sometimes also referred to as “phosphite,” means the salts (organic or inorganic) of either phosphonic acid or phosphorous acid. Phosphonic and phosphorous acids have the formula H_3PO_3 and a molecular weight of 82.00. Their structures from the International Union of Pure and Applied Chemistry are shown below:



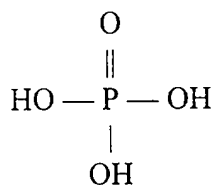
Phosphonic Acid

CA: 13598-36-2

Phosphorous Acid

CA: 10294-56-1

The term “phosphate” means the salts (organic or inorganic) of phosphoric acid having the formula H_3PO_4 , molecular weight of 98, and has the following structure:



Phosphoric Acid

CA: 7664-38-2

5 In the past, various phosphonate compounds have been proposed as useful in fungicidal and fertilizer compositions for application to plants. See, e.g., U.S. Patent Nos. 4,075,324 and 4,119,724 to Thizy, describing phosphorous acid, its inorganic and organic salts, as a plant fungicide; U.S. Patent No. 4,139,616 to Dueret, describing fungicidal compositions based on phosphorous acid esters and salts thereof; U.S. Patent No. 4,542,023 to Lacroix et al., describing organophosphorus derivatives as possessing systemic and contact fungistatic and fungicidal activity; U.S. Patent Nos. 4,698,334 and 4,806,445 and 5,169,646 to Horriere et al., describing fungicidal compositions based on alkyl phosphonates; U.S. Patent Nos. 4,935,410 and 5,070,083 to Barlet, describing fungicidal aluminum tris-alkyl-phosphonate compositions; and U.S. Patent No. 5,514,200 to Lovatt, describing formulations of phosphorous-containing acid fertilizer for plants. (The teachings of the proceeding U.S. Patents are hereby incorporated by reference.) The above references disclose phosphonate compositions have been found to be effective for protecting plants, and particularly grape vines, citrus and fruit trees and tropical plants, against fungal attack.

15 Once assimilated, phosphonates have been shown to enhance the phytoimmune system. The phosphonate induced stimulation of the phytoimmune system is triggered by the induction of ethylene production, followed by a rapid accumulation of phytoalexins at the site of infection. Phosphonates have also been shown to have detrimental effect on the growth of Phycomycetes. See, Pegg, K.G. and deBoer, R.F., "Proceedings of the Phosphonic (Phosphorous) Acid Work Shop, *"Australasian Plant Pathology*, Vol. 19 (4) 1990.

20 In accordance with this development of the present invention, however, it has recently been discovered that phosphonates exacerbate the non-target Ascomycete fungi, and

other fungi producing an eiphytotic outbreak of much greater magnitude than the infections occurring without phosphonate treatment. This phenomenon is known as pathological acerbation.

In the past, phosphates were not viewed as a solution to pathological acerbation of Ascomycete fungal infections. This is because phosphates are viewed primarily as a fertilizer with only limited, or even detrimental, fungical properties. For example, U.S. Patent 5,514,200 teaches that phosphate fertilizers inhibit beneficial symbiosis between plant roots and mycorrhizal fungi, and further promote bacterial and fungical growth in the rhizosphere, including the growth of pathogenic fungi and other small soil-borne organisms. (Col. 2, lines 18-28). Phosphates have also been considered to be a competitive inhibitor for phosphonate assimilation, thus inhibiting the ability of phosphonates to protect against fungus attack. See, Pegg, K.G. and deBoer, R.F., "Proceedings of the Phosphonic (Phosphorous) Acid Work Shop, *Australasian Plant Pathology*, Vol. 19 (4), pp. 117 and 144, 1990. Yet further, phosphonates and phosphates were believed to be "biological strangers," with the presence of phosphonates or its esters, exerting little or no influence on enzyme reactions involving phosphates. Robertson, H.E. and Boyer, P.D., "The Biological Inactivity of Glucose 6 — phosphonate, Inorganic Phosphites and Other Phosphites," *Archives of Biochemistry and Biophysics*, 62 pp. 380-395 (1956).

Accordingly, the requirements for a successful phosphonate-based fungicide depend on the elimination of the phosphonate-induced pathological ascerbation of Ascomycete fungical infections.

Moreover, the prior art teaching that phosphates and phosphonates are "biological strangers" is relevant to the lack of teaching of use of a composition of both for any agricultural use.

Summary of the Invention

5 The present invention addresses the problems outlined above, and provides an improved anti-fungicidal composition for plants that contains, as active ingredients, fungicidally effective amounts of both phosphonates and phosphates. According to the present invention, it has been discovered that the application to a plant of the inventive phosphonate/phosphate composition substantially eliminates pathological acerbatation of Ascomycete fungi, while at the same time, provides a means to control Phycomycetes and Ascomycetes and other fungi with a single product.

Thus, an object of present invention is to provide a fungicidal composition for protection for plants against fungal infection, especially Phycomycetes and Ascomycetes.

Another object of the invention is to provide such anti-fungal protection with a single product that upon application does not cause pathological acerbatation of Ascomycetes infections.

A further object of the invention is to provide a method of treating plants and to provide anti-fungal protection in plants against attack by Phycomycetes, Ascomycete and other fungi and bacteria.

20 A yet further object of the invention is to provide an anti-fungal composition for treating plants that is environmentally safe, inexpensive to use and has low mammalian toxicity.

These and other objects of the invention are attained by the invention disclosed below. According to the invention, anti-fungicidal compositions for the protection of plants, especially citrus and fruit trees and vines against fungus attack, preferably contain as an active material a fungicidally effective amount of at least a first salt formula selected from the group consisting of KH_2PO_3 , K_2HPO_3 , and K_3PO_3 , and at least a second salt selected from the group consisting of KH_2PO_4 , K_2HPO_4 and K_3PO_4 , in a mixture with an agriculturally acceptable carrier.

The composition preferably comprises an aqueous solution wherein each salt is present in solution from about 20 millimole to about 5% vol./vol..

According to another aspect of the invention, the amount of the first salt is one part by weight and the amount of the second salt is between 0.001 and 1,000 parts by weight.

Phosphonate salts useful in the practice of the invention also include those organic and inorganic salts taught by U.S. Patent Nos. 4,075,324 and 4,119,724 to Thizy et al., (see, e.g., col. 1, ln. 51-69 through col. 2, ln. 1-4).

The present invention, in another aspect, also has been found to be effective as a growth stimulator or fertilizer for plants, and addresses the problems in the art with regard to finding effective fertilizers. Thus, the present invention provides a means for applying a single product to plants which is both an effective fungicide and an effective fertilizer.

It is therefore an object of this aspect of the invention to present a composition and method of use which functions as a fertilizer for plants.

A further object of this aspect of the invention is to function as a fertilizer which provides substantial growth response results.

Another object of this aspect of the invention is to function as a fertilizer which is ecologically and human compatible, is economical, and is efficient.

These and other objects, features and advantages of the invention will become more apparent with reference to the accompanying specification and claims.

A Detailed Description of the Preferred Embodiments.

The following examples set for preferred concentrations and techniques for formulation thereof, as well as methods of application and use and test results demonstrating the efficacy of the inventive concentration in protecting plants against attack by Ascomycete and Phycomycete fungi. It is to be understood, however, that these Examples are presented by way of illustration only and nothing therein shall be taken as a limitation upon the overall scope of the invention. The specific components tested in the Examples were prepared and applied as follows.

Method of Preparation

A. Potassium Phosphonate (KH_2PO_3) Aqueous Solution. H_3PO_3 is produced by the hydrolysis of phosphorus trichloride according to the reaction: $\text{PCl}_3 + 3\text{H}_2\text{O} > \text{H}_3\text{PO}_3 + 3\text{HCl}$. The HCl is removed by stripping under reduced pressure and the phosphonic acid (H_3PO_3) is sold as a 70% acid solution.

The phosphonic acid is then neutralized in aqueous solution by potassium hydroxide according to the reaction: $\text{H}_3\text{PO}_3 + \text{KOH} > \text{KH}_2\text{PO}_3 + \text{H}_2\text{O}$ to about pH 6.5 and to produce a 0-22-20 liquid weighing 11.15 lbs./gal. This solution is commercially available and is sold under the trademark "Phos-Might" by Foliar Nutrients, Inc., Cairo, GA 31728.

B. Potassium Phosphate (K₂HPO₄) Aqueous Solution. Mono potassium phosphate (0-51.5-34) is reacted with 45% potassium hydroxide in aqueous solution to produce dipotassium phosphate by the following reaction: This solution is commercially available and is sold under trademark "K-Phos" by Foliar Nutrients, Inc., Cairo, GA 31724

5 $\text{KH}_2\text{PO}_4 + \text{KOH} \rightarrow \text{K}_2\text{HPO}_4 + \text{H}_2\text{O}$ with a product density of 1.394 at 20 C and a solution pH of 7.6 producing a 0-18-20 analysis.

C. KH₂PO₃/K₂HPO₄ Solution. Varying amounts of each compound (K₂HPO₃;KH₂PO₃; K₂HPO₄; or KH₂PO₄) in aqueous solution are combined at rates ranging from 20 millimole to 5% vol./vol., depending on crop host and the pathogen complex and level of infection.

Method of Application

The preferable method of application is foliar, either by ground or aerial equipment, but is not limited to that method alone. Injection or soil applications, for example, could also be efficacious depending on specific crops and pathogens.

15 The inventive compositions have utility on fruit crops, agronomic crops, ornamentals, trees, grasses, vegetables, grains, and floricultural crops, as well as, some aquatic crops including water cress.

The fungicidal properties of the compounds according to the invention are various, but are particularly interesting in the case described in the following examples:

20 Examples 1-5 exemplify a portion of these applications. In Examples 1-4, fungicidal treatments were applied to ornamentals, citrus and vegetables. In each of Examples 1-4,

treatments were applied as a one gallon solution by a back pack sprayer, maintained at about 60 psi, in sufficient quantities of water to achieve thorough coverage.

All treatments were applied to the appropriate number of experimental units assigned in a randomized complete block (RCB) design replicated four times. Example #5 was a pre-harvest fungicidal spray evaluation on "Nova" tangelos.

As used in the examples, "percent infection" means percent of leaves that exhibit fungus lesions. "Phytotoxicity" means number crop injury to leaves that fell off the plant following the application of the solution.

The Ascomycete fungi were the subjects of testing in Examples 1 through 5 and are all members of the Ascomycete family.

EXAMPLE NO. 1

Dogwood\Powdery Mildew Fungicide Trial
Trail Ridge Nursery, Keystone Hts., Florida

The compounds according to the invention are studied for the effect on the powdery mildew (*Oidium Spp.*), which is responsible for foliar infections in dogwood.

Potassium phosphonate and potassium phosphate solutions were applied in compositions as set forth in Table 1 below. An average of 5 six-inch pots per experimental unit with 4 repetitions in a randomized complete block ("RCB") design were considered. The solutions were applied to Dogwood (*Cornis Florida Var. "Weaver"*). The application of the compositions were made in April 25, 1996, May 8, 1996, and May 23, 1996. The effects of the various compositions were rated on May 30, 1996.

Table 1 shows that when a potassium phosphonate solution (containing no appreciable amount of phosphate) is applied to dogwood, pathological acerbation of the Ascomycete fungus occurs in 100 percent of the dogwood leaves, in contrast to the control, which exhibited only 30 percent infection. The inventive composition that combine potassium phosphate and potassium phosphonate showed a complete elimination of the pathological acerbation phenomenon, and in fact, dropped the amount of infection by about 20 percent.

TABLE 1

<u>TREATMENT</u>	<u>RATE/100 gal.</u>	<u>*%INFECTION</u>	<u>PHYTOTOXICITY</u>
1) POTASSIUM PHOS- PHONATE SOLUTION	1%	100	0
2) POTASSIUM PHOS- PHATE SOLUTION	1%	0	0
3) POTASSIUM PHOS- PHONATE SOLUTION	1%	10	0
+ POTASSIUM PHOS- PHATE SOLUTION	+		0
4) POTASSIUM PHOS- PHATE SOLUTION	2%	0	0
5) CONTROL	-	30	0

EXAMPLE NO. 2

Shumard Oak/Powdery Mildew Fungicide Trial Trail Ridge Nursery, Keystone Hts., Florida

In Example No. 2, the inventive compositions were tested for effectiveness against the powdery mildew (*Phyllactinia corylea*) that infects shumard oak (*Quercus shumardii*). In Example No. 2, an average of ten 3-gallon plots per experimental unit with 4 repetitions in a randomized complete block design were examined.

When only potassium phosphonate solution was applied, the percentage of infection increased to 40 percent, compared to a 20 percent infection in the control, indicating a pathological acerbation of the Ascomycete fungi. When the inventive composition including potassium phosphonate and potassium phosphate was applied, the infection was completely eliminated.

TABLE 2

<u>TREATMENT</u>	<u>RATE/100 gal.</u>	<u>*%INFECTION</u>	<u>PHYTOTOXICITY</u>
1) POTASSIUM PHOSPHONATE SOLUTION	1%	40	0
2) POTASSIUM PHOSPHATE SOLUTION	1%	0	0
3) POTASSIUM PHOSPHONATE SOLUTION	1%	0	0
+ POTASSIUM PHOSPHATE SOLUTION	+ 1%		
4) POTASSIUM PHOSPHATE SOLUTION	2%	0	0
5) CONTROL	-	20	0

EXAMPLE NO. 3

Citrus Alternaria Fungicide Trial
Kerr Center, Vero Beach, Florida

In Example No. 3, the inventive composition was tested for effectiveness in citrus trees (*Alternaria citri*) that were infected with the fungi.

As used in Table No. 3 below, "% Y.L.D." means percent young leaf drop, and "% Y.F.D." means percent young fruit drop. %Y.L.D. and %Y.F.D. were determined by examining 4 terminals/tree with 4 repetitions in a randomized complete block design. The date on which the compositions were applied were March 21, 1996. The compositions were rated on April 2, 1996. When only potassium phosphonate solutions were applied, %Y.L.D. and %Y.F.D. increased from 6.2 and 1.5 to 23.9 and 37.9, respectively, indicating pathological acerbatation of the Ascomycete fungi. Application of the inventive composition not only eliminated the acerbatation, but showed an improvement in Y.L.D. and Y.F.D.

TABLE 3

<u>TREATMENT</u>	<u>RATE/100 gal.</u>	<u>%Y.L.D.</u>	<u>%Y.F.D.</u>	<u>PHYTOTOXICITY</u>
1) POTASSIUM PHOSPHATE SOLUTION	0.5%	5.2	3.8	0
2) POTASSIUM PHOSPHATE SOLUTION	1 %	2.5	2.5	0
3) POTASSIUM PHOSPHATE SOLUTION	2 %	1.5	1.0	0
4) POTASSIUM PHOSPHONATE SOLUTION	1 %	23.9	37.5	0

5) POTASSIUM PHOS- PHATE SOLUTION	0.5%	2.2	3.7	0
+ POTASSIUM PHOS- PHONATE SOLUTION	+ 0.5%			
6) CONTROL	-	6.2	1.5	0

EXAMPLE NO. 4

Carrot/*Alternaria* Fungicide Trial

In Example No. 4, carrot plots were inoculated with *Alternaria dauci* fungi. The plot sizes were single rows X 25 feet X 4 repetitions in a RCB design. The dates that compositions were applied were February 2, 9, 15, 22, and March 8, 14, 22, and 28, 1996. The fungi infections were rated on April 5 and April 23, 1996. The second rating was 25 days after the last fungicide application. The test took place at Sanford, Florida.

Application of the inventive solutions including potassium phosphonate and potassium phosphate improved the extent of infection from that otherwise occurring in the control carrots. Although the solution making use of only potassium phosphonate caused a slight improvement from the infection occurring in the control, it was substantially less than that associated with the inventive composition.

Also shown in Example No. 4 is a comparison of the effectiveness of the inventive composition to other fungicides, including Cu-Alexin and Fe-Alexin. This test demonstrates that the inventive composition is as effective as other well known fungicides, but without being as environmentally toxic.

TABLE 4

TREATMENT	RATE/100 GAL.	AVG% INFECTION	
		<u>4/5/96</u>	<u>4/23/96</u>
1) POTASSIUM PHOSPHATE SOLUTION	1%	6.9	8.2
2) POTASSIUM PHOSPHONATE SOLUTION	1%	18.7	28.8
3) POTASSIUM PHOSPHATE SOLUTION	0.5%	8.9	10.7
+ POTASSIUM PHOSPHONATE SOLUTION	+ 0.5%		
4) Cu-ALEXIN	0.2 lb ai	8.8	11.6
5) Fe-ALEXIN	0.2 lb ai	12.7	12.9
6) CONTROL	-	23.0	34.8

EXAMPLE NO. 5

Citrus Preharvest Spray Trials
Kerr Center, Vero Beach, Florida

In Example No. 5, twenty-two fruits, each from five nova tangelo trees, were randomly selected and marked. The fruits were scuffed with an emery board and then sprayed with the compositions set forth below in Table 5, with five treatments on the same day. Seven days later, the fruit was picked and stored for two weeks in sealed white plastic bags, then examined for penicillium mold.

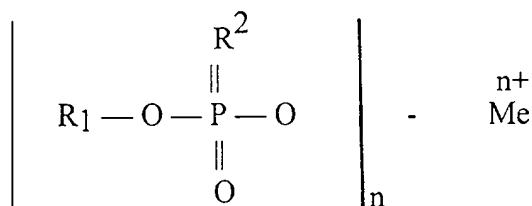
The degree of infection was rated using following scores: 0 = no infection, 1 = light infection (less than 30% coverage), 2 = severe infection (100% coverage). The degree of infection is the mean of scores from 22 fruit.

TABLE 5

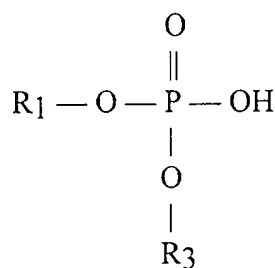
<u>TREATMENT</u>	<u>RATE</u>	<u>DEGREE OF INFECTION</u>	<u>#ROTTEN FRUIT</u>	<u>PHYTOTOXICITY</u>
1) POTASSIUM PHOSPHONATE SOLUTION	1%	1	9	0
2) POTASSIUM PHOSPHONATE SOLUTION	2%	0.91	12	0
3) POTASSIUM PHOSPHATE SOLUTION	1%	0	0	0
4) POTASSIUM PHOSPHATE SOLUTION	0.5%	0.27	3	0
+ POTASSIUM PHOSPHONATE SOLUTION	+ 0.5%			
5) CONTROL	-	1.41	12	0

The above Examples demonstrate that the inventive compositions are useful in protecting plants against attack by Phycomycete , Ascomycete and other fungi and bacteria with the application of one solution.

It will also be appreciated that compositions for controlling Phycomycete and Ascomycete fungi diseases in plants may also contain phosphate and phosphonate compounds comprising a fungicidally effective amount of at least a first salt having the following formula:



And a second salt having the following formula:



Where R₁ is selected from group consisting of H, K, an alkyl radical containing from 1 to 4 carbon atoms, halogen-substituted alkyl or nitro-substituted alkyl radical, an alkenyl, halogen-substituted alkenyl, alkynyl, halogen-substituted alkynyl, alkoxy-substituted alkyl radical, ammonium substituted by alkyl and hydroxy alkyl radicals;

R₂ and R₃ are selected from a group consisting of H and K;

Me is selected from a group consisting of K, alkaline earth metal cations, aluminum atom; ammonium cation; and

n is a whole number from 1 to 3, equal to the valence of Me.

It will be appreciated that foliar applications of the inventive compositions will be effective as a common agricultural practice to control root pathogens caused by *Phytophthoran*, *Phythium*, and foliar infections caused by *Plasmopara*.

It will also be appreciated that the inventive compositions will have biocidal and arthropod pest control activity, and also have fertilizer effects, in plants. (See e.g., U.S. Pat. Nos. 5,206,228, 5,133,891 and 5,514,200).

According to another aspect of the invention, compositions including both potassium phosphate and potassium phosphonate have been found to produce substantial growth response in certain plants. Table 6 below is illustrative:

TABLE 6

FOLIAR NUTRITIONAL EVALUATIONS OF K-PHOS AND PHOS-MIGHT ON RHAPHIOLEPIS INDICA

TREATMENT	RATE	No. of Shoots/Rep.				AVG
		A	B	C	D	
1) POTASSIUM PHOSPHONATE SOLUTION	1%	22	13	20	15	17.5
2) POTASSIUM PHOSPHATE SOLUTION	1%	28	23	25	32	27.0
3) POTASSIUM PHOSPHONATE SOLUTION	1/2%	23	26	24	8	20.3
+ POTASSIUM PHOSPHATE SOLUTION	+ 1/2%					

4) POTASSIUM PHOSPHATE SOLUTION	2%	24	38	32	24	29.5
---------------------------------------	----	----	----	----	----	------

5) CONTROL-	--	4	1	7	3	3.8
-------------	----	---	---	---	---	-----

Experimental units = 3 x 3 gallon containers x 4 repetitions with treatments assigned in a randomized complete block design. Application dates for treatments A-D were approximately one, two, four, and three weeks apart respectively (October 31, 1996; November 7, 1996; November 20, 1996, December 19, 1996, and January 8, 1997 respectively; rated January 14, 1997).

As can be seen by Table 6, all four nutritional treatments provided growth responses greater than the untreated control, and K-PHOS at 1% and 2% were superior to PHOS-MIGHT at 1% and the combination of 1/2% each of PHOS-MIGHT + K-PHOS. The combination, however, produced substantially higher growth responses than the control, in fact, on a level similar to the individual treatments of K-PHOS or PHOS-MIGHT. The higher growth responses, compared to the control, can be expected when the inventive composition of Potassium Phosphate salt and Potassium phosphonate salt aqueous solution wherein each said salt is present in solution from about .25% vol./vol. to about 3.0% vol./vol., and preferably between .5% vol./vol. and 2.0% vol./vol. It is theorized that the unexpected growth responses are due to the slow conversion of PO_3 in the inventive composition to PO_4 after application. This composition further provides the added benefit of being fungicidal as well.

The disclosures in all references cited herein are incorporated by reference.

What is Claimed is:

1. A fertilizer composition for stimulating growth in plants comprising:

a growth stimulating effective amount of at least a first salt selected from a group consisting of K_2HPO_3 , KH_2PO_3 and K_3PO_3 ; and a second salt selected from a group consisting of K_2HPO_4 , KH_2PO_4 and K_3PO_4 .

2. The composition according to claim 1 wherein said composition comprises an aqueous solution, wherein each said first and second salt being present in solution from about .25% vol./vol. to about 5% vol./vol.

3. The composition according to claim 1 wherein the amount of said first said salt is one part by weight and the amount of said second salt is between 0.001 and 1,000 parts by weight.

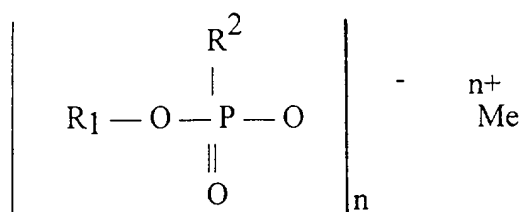
4. A method of stimulating growth in plants comprising:
applying to the plants in growth stimulating effective amounts at least a first salt selected from a group consisting of K_2HPO_3 , KH_2PO_3 and K_3PO_3 ; and a second salt selected from a group consisting of K_2HPO_4 , KH_2PO_4 and K_3PO_4 .

5. The method according to claim 4 wherein said composition comprises an aqueous solution, wherein each said first and second salt being present in solution from about .25% vol./vol. to about 5% vol./vol.

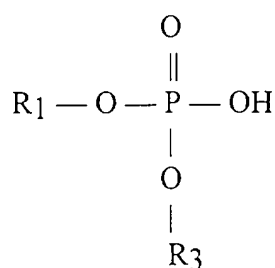
6. The method according to claim 4 wherein the amount of said first said salt is one part by weight and the amount of said second salt is between 0.001 and 1,000 parts by weight.

7. A composition for fertilizing comprising:

a growth stimulating effective amount of at least a first salt having the following formula:



and a second salt having the following formula:



where R₁ is selected from group consisting of H, K, an alkyl radical containing from 1 to 4 carbon atoms, halogen-substituted alkyl or nitro-substituted alkyl radical, an alkenyl, halogen-substituted alkenyl, alkynyl, halogen-substituted alkynyl, alkoxy-substituted alkyl radical, ammonium substituted by alkyl or hydroxy alkyl radicals;

R₂ and R₃ are selected from a group consisting of H and K;

Me is selected from a group consisting of K, alkaline earth metal cations, or aluminum atom; ammonium cation; and

n is a whole number from 1 to 3, equal to the valence of Me.

8. The composition according to claim 7 wherein said composition comprises an aqueous solution, wherein each said first and second salt being present in solution from about .25% vol./vol. to about 5% vol./vol.

9. The composition according to claim 7 wherein the amount of said first said salt is one part by weight and the amount of said second salt is between 0.001 and 1,000 parts by weight.

10. The composition according to claim 1 which is fungicidal.

11. A fungicidal/fertilizer composition comprising from about .25% vol./vol. to about 5% vol./vol. of a phosphite salt and a phosphate salt mixture.

12. A composition according to claim 10 wherein the phosphite salt and the phosphate salt each comprise about 1/2% by weight of the composition.

13. A composition according to claim 10 which is aqueous.

ABSTRACT OF THE DISCLOSURE

A fertilizer composition for plants containing phosphonate and phosphate salts, and derivatives thereof is disclosed. The composition provides a single product which may be employed to stimulate the growth response in plants.

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT,
SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

- ☐ original
- ☐ design
- ☐ supplemental
- ☐ national stage of PCT
- ☐ divisional
- ☐ continuation
- ☒ continuation-in-part

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name. I believe I am the owner of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**FERTILIZER COMPOSITIONS FOR PLANTS CONTAINING
PHOSPHONATE AND PHOSPHATE SALTS, AND DERIVATIVES THEREOF****SPECIFICATION IDENTIFICATION**

the specification of which:

- ☐ is attached hereto.
- ☒ was filed on March 5, 1997 as Serial No. 08/312,315, or
Express Mail No., as Serial No. not yet known and was amended on
_____ (if applicable).

- ☐ was described and claimed in PCT International Application No. _____
filed on _____ and as amended on PCT Article 19 on
_____ (if any).

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-mentioned specification, including the claims, as amended by any amendment referred to above (if any).

I acknowledge the duty to disclose all information known to me to be material to patentability of this application in accordance with Title 37, Code of Federal Regulations, § 1.56 (a).

- ☐ In compliance with this duty there is attached an information disclosure statement 37 CFR 1.97.

☒ **CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATION(S) UNDER 35 U.S.C. 120**

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of the application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATION(S)
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 USC 120

U.S. APPLICATION(S)		STATUS (Check One)		
US APPLICATION(S)	US FILING DATE	PATENTED	PENDING	ABANDONED
<input checked="" type="checkbox"/> 08/705,594	August 30, 1996	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> /		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> /		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ PCT APPLICATION(S) DESIGNATING THE U.S. _____

PCT
APPLICATION
NUMBER

PCT FILING
DATE

U.S. SERIAL NUMBERS
ASSIGNED (if any)

<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____
<input type="checkbox"/>	_____	_____	_____

**35 USC 119 PRIORITY CLAIM, IF ANY, FOR ABOVE LISTED
U.S./PCT APPLICATIONS**

**DETAILS OF FOREIGN APPLICATION FROM WHICH PRIORITY
CLAIMED UNDER 35 USC 119**

ABOVE APPLICATION NUMBER	COUNTRY APPLICATION NUMBER	DATE OF FILING (day, mo.yr.)	DATE OF ISSUE (day,mo.yr.)
--------------------------------	----------------------------------	------------------------------------	-------------------------------

1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

☐ **PRIORITY CLAIM**

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

- ☐ no such applications have been filed.
☐ such applications have been filed as follows.

earliest foreign application(s), if any filed within 12 months (6 months for design) prior to this U.S. application

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day,month,year)	PRIORITY CLAIMED UNDER 37 USC 119
---------	-----------------------	---------------------------------------	---

			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

all foreign application(s), if any filed more than 12 months (6 months for design) prior to this U.S. application

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

William A. Rudy, Reg. No. 34,916
 Peter C. Knops, Reg. No. 37,659
 LATHROP & GAGE L.C.,
 2345 Grand Boulevard
 Kansas City, Missouri 64108-2684
 816-460-5819 (phone)
 816-460-2001(fax)

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

Inventor's signature:  Date: 3/24/97

Full name of inventor: John B. Taylor

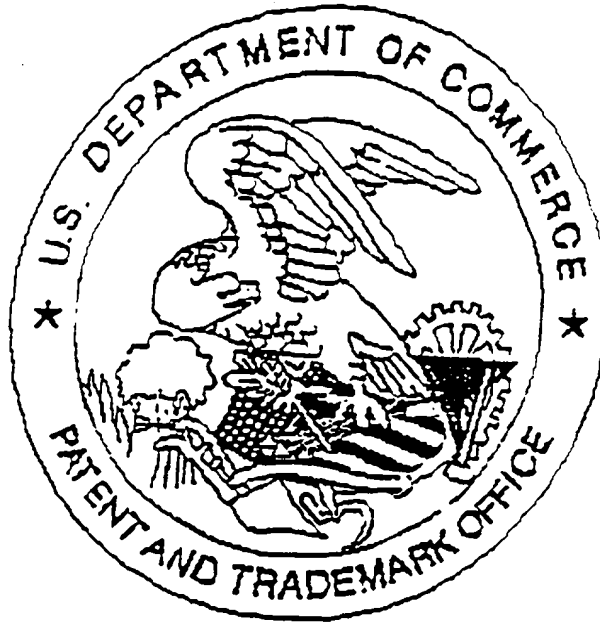
Residence: 1420 Lemon Street, Deland, Florida, ³²91720 (Volusia County)

Post Office Address

Country of Citizenship: United States of America

United States Patent & Trademark Office

Office of Initial Parent Examination — Scanning Division



Application deficiencies found during scanning:

1. Application papers are not suitable for scanning and are not in compliance with 37 CFR 1.5 because:

- ☐ All sheets must be the same size and either A4 (21 cm x 29.7 cm) or 8-1/2" x 11" Pages _____ do not meet these requirements.
- ☐ Papers are not flexible, strong, smooth, non-shiny, durable, and white.
- ☐ Papers are not typewritten or mechanically printed in permanent ink on one side.
- ☐ Papers contain improper margins. Each sheet must have a left margin of at least 2.5 cm (1") and top, bottom and right margins of at least 2.0 cm (3/4").
- ☐ Papers contain hand lettering.

2. Drawings are not in compliance and were not scanned because:

- ☐ The drawings or copy of drawings are not suitable for electronic reproduction.
- ☐ All drawings sheets are not the same size. Pages must be either A4 (21 cm x 29.7 cm) or 8-1/2" x 11"
- ☐ Each sheet must include a top and left margin of at least 2.5 cm (1"), a right margin of at least 1.5 cm (9/16") and a bottom margin of at least 1.0 cm (3/8").

3. Page(s) _____ are not of sufficient clarity, contrast and quality for electronic reproduction.

4. Page(s) _____ are missing.

5. ☒

NO DRAWINGS ENCLOSED